

### **Listing of Claims:**

This listing of claims reflects all claim amendments and replaces all prior versions, and listings, of claims in the application (material to be inserted in amended claims is in **bold and underline**, and material to be deleted is in ~~strikeout~~).

Please cancel claims 45-52 without prejudice.

Please add new claims 53-56 as set out below.

1-17. (Canceled).

18. (Withdrawn). A method of producing heavy oxygen water, comprising:  
obtaining an enriched material which has been enriched in at least one component from  
oxygen molecules which contain heavy oxygen isotopes by means of  
cryogenic distillation of an oxygen starting material which contains heavy  
oxygen isotopes using an apparatus according to claim 12;  
obtaining water containing heavy oxygen water corresponding to said enriched material by  
adding hydrogen to said enriched material; and, thereafter,  
further enriching said heavy oxygen water using an apparatus according to claim 12.

19-24. (Canceled).

25. (Withdrawn) A method of producing heavy oxygen water, comprising:  
obtaining an enriched material which has been enriched in at least one component from  
oxygen molecules which contain heavy oxygen isotopes by means of  
cryogenic distillation of an oxygen starting material which contains heavy

oxygen isotopes using an apparatus according to claim 19;  
obtaining water containing heavy oxygen water corresponding to said enriched material by  
adding hydrogen to said enriched material; and, thereafter,  
further enriching said heavy oxygen water using an apparatus according to claim 19.

26. (Withdrawn) A method of producing heavy oxygen water, comprising:  
obtaining an enriched material which has been enriched in at least one component from  
oxygen molecules which contain heavy oxygen isotopes by means of  
cryogenic distillation of an oxygen starting material which contains heavy  
oxygen isotopes using an apparatus according to claim 19;  
obtaining water containing heavy oxygen water corresponding to said enriched material by  
adding hydrogen to said enriched material; and, thereafter,  
further enriching said heavy oxygen water using an apparatus according to claim 19.

27. (Withdrawn) A method of producing heavy oxygen water, comprising:  
obtaining an enriched material which has been enriched in at least one component from  
oxygen molecules which contain heavy oxygen isotopes by means of  
cryogenic distillation of an oxygen starting material which contains heavy  
oxygen isotopes using an apparatus according to claim 12;  
obtaining water containing heavy oxygen water corresponding to said enriched material by  
adding hydrogen to said enriched material; and, thereafter,  
further enriching said heavy oxygen water using an apparatus according to claim 12.

28. (Withdrawn) A method of enrichment of oxygen isotopes in which an  
oxygen starting material containing heavy oxygen isotopes is enriched by means of a

cascade process using a plurality of distillation columns (a first column to an  $n^{\text{th}}$  column) comprising:

supplying at least a part of a vapor from the bottom of a  $k^{\text{th}}$  ( $1 \leq k \leq (n-1)$ ) column or an outlet of a reboiler provided in the vicinity of the bottom of the  $k^{\text{th}}$  column to the top of a  $(k+1)^{\text{th}}$  column, an inlet of a condenser provided in the vicinity of the top of the  $(k+1)^{\text{th}}$  column, or a middle section of the  $(k+1)^{\text{th}}$  column;

returning at least a part of the liquid from the top of the  $(k+1)^{\text{th}}$  column or an outlet of the condenser of the  $(k+1)^{\text{th}}$  column to an inlet of a reboiler of the  $k^{\text{th}}$  column, the bottom of the  $k^{\text{th}}$  column, or the middle section of the  $k^{\text{th}}$  column;

carrying out enrichment in at least one type of oxygen molecule of  $^{16}\text{O}^{17}\text{O}$ ,  $^{16}\text{O}^{18}\text{O}$ ,  $^{17}\text{O}^{17}\text{O}$ ,  $^{17}\text{O}^{18}\text{O}$ , and  $^{18}\text{O}^{18}\text{O}$ , which contain heavy oxygen isotopes.

29. (Withdrawn) A method of enrichment of oxygen isotopes comprising subjecting an oxygen isotope-enriched material enriched by means of a method of enrichment according to claim 28 to oxygen isotope scrambling to obtain an enriched product having an even higher concentration of at least one type of said oxygen molecules which contain heavy oxygen isotopes.

30. (Withdrawn) A method of enrichment of oxygen isotopes comprising: subjecting an oxygen isotope-enriched material enriched by means of a method of enrichment according to claim 28 to oxygen isotope scrambling to obtain an enriched product having an even higher concentration of at least one type of said oxygen molecules which contain heavy oxygen isotopes; and obtaining an enriched product having an even higher concentration of at least one type of

said oxygen molecules which contain heavy oxygen isotopes by means of conducting a method of enrichment according to claim 28 again on said enriched material.

31. (Withdrawn) A method of enrichment of oxygen isotopes in which an oxygen starting material containing heavy oxygen isotopes is enriched by means of a cascade process using a plurality of distillation columns (a first column to an  $n^{\text{th}}$  column) comprising:

supplying at least a part of a vapor from the bottom of a  $k^{\text{th}}$  ( $1 \leq k \leq (n-1)$ ) column or an outlet of a reboiler provided in the vicinity of the bottom of the  $k^{\text{th}}$  column to the top of a  $(k+1)^{\text{th}}$  column, an inlet of a condenser provided in the vicinity of the top of the  $(k+1)^{\text{th}}$  column, or a middle section of the  $(k+1)^{\text{th}}$  column; returning at least a part of the liquid from the top of the  $(k+1)^{\text{th}}$  column or an outlet of the condenser of the  $(k+1)^{\text{th}}$  column to an inlet of a reboiler of the  $k^{\text{th}}$  column, the bottom of the  $k^{\text{th}}$  column, or the middle section of the  $k^{\text{th}}$  column; carrying out enrichment in at least one type of oxygen molecule of  $^{16}\text{O}^{17}\text{O}$ ,  $^{16}\text{O}^{18}\text{O}$ ,  $^{17}\text{O}^{17}\text{O}$ ,  $^{17}\text{O}^{18}\text{O}$ , and  $^{18}\text{O}^{18}\text{O}$ , which contain heavy oxygen isotopes.

32. (Withdrawn) A method of enrichment of oxygen isotopes comprising subjecting an oxygen isotope-enriched material enriched by means of a method of enrichment according to claim 31 to oxygen isotope scrambling to obtain an enriched product having an even higher concentration of at least one type of said oxygen molecules which contain heavy oxygen isotopes.

33. (Withdrawn) A method of enrichment of oxygen isotopes comprising:  
subjecting an oxygen isotope-enriched material enriched by means of a method of enrichment according to claim 31 to oxygen isotope scrambling to obtain an enriched product having an even higher concentration of at least one type of said oxygen molecules which contain heavy oxygen isotopes; and  
obtaining an enriched product having an even higher concentration of at least one type of said oxygen molecules which contain heavy oxygen isotopes by means of conducting a method of enrichment according to claim 31 again on said enriched material.

34. (Withdrawn) A method of enrichment of oxygen isotopes comprising:  
subjecting an oxygen isotope-enriched material enriched by means of a method of enrichment according to claim 31 to oxygen isotope scrambling to obtain an enriched product having an even higher concentration of at least one type of said oxygen molecules which contain heavy oxygen isotopes; and  
obtaining an enriched product having an even higher concentration of at least one type of said oxygen molecules which contain heavy oxygen isotopes by means of conducting a method of enrichment according to claim 28 again on said enriched material.

35. (Withdrawn) A method of enrichment of oxygen isotopes comprising:  
subjecting an oxygen isotope-enriched material enriched by means of a method of enrichment according to claim 28 to oxygen isotope scrambling to obtain an enriched product having an even higher concentration of at least one type of said oxygen molecules which contain heavy oxygen isotopes; and  
obtaining an enriched product having an even higher concentration of at least one type of

said oxygen molecules which contain heavy oxygen isotopes by means of conducting a method of enrichment according to claim 31 again on said enriched material.

36. (Withdrawn) A method of enrichment of oxygen water in which a water starting material containing heavy oxygen water is enriched by means of a cascade process using a plurality of distillation columns comprising:

supplying at least a part of the water vapor from the bottom of a  $k^{\text{th}}$  ( $1 \leq k \leq (n-1)$ ) column or an outlet of a reboiler provided in the vicinity of the bottom of the  $k^{\text{th}}$  column to the top of a  $(k+1)^{\text{th}}$  column, an inlet of a condenser provided in the vicinity of the top of the  $(k+1)^{\text{th}}$  column, or a middle section of the  $(k+1)^{\text{th}}$  column;

introducing at least a part of the liquid from the top of the  $(k+1)^{\text{th}}$  column or an outlet of the condenser of the  $(k+1)^{\text{th}}$  column to an inlet of a reboiler of the  $k^{\text{th}}$  column, the bottom of the  $k^{\text{th}}$  column, or the middle section of the  $k^{\text{th}}$  column; and, thereby carrying out enrichment in at least one type of heavy oxygen water of  $\text{H}_2, ^{17}\text{O}$ ,  $\text{H}_2, ^{18}\text{O}$ ,  $\text{D}_2, ^{17}\text{O}$ ,  $\text{D}_2, ^{18}\text{O}$ ,  $\text{DH}^{17}\text{O}$ , and  $\text{DH}^{18}\text{O}$ , which contain heavy oxygen isotopes.

37-52. (Canceled).

53. (New) An apparatus for distilling heavy isotopes from a vapor or a liquid constituted by a plurality of isotopes, comprising:

a plurality of distillation columns constructed in a cascade,

wherein each of the columns comprises a reboiler and a condenser;

a liquid drawn from each of the columns being introduced into the reboiler;

a vapor drawn from each of the columns being introduced into the condenser;

an outlet of the reboiler of the first column is directly connected to an inlet of the condenser of the second column via introduction conduits, which introduce a portion of a vapor drawn from the reboiler of the first column into the condenser of the second column;

the outlet of the reboiler of the first column is connected to the first column by means of a conduit which returns another portion of the vapor drawn from the reboiler to the first column;

an outlet of the condenser of the second column is directly connected to an inlet of the reboiler of the first column via return conduits, which return a portion of a liquid drawn from the condenser of the second column into the reboiler of the first column; and

the outlet of the condenser of the second column is connected to the second column by means of a conduit which returns another portion of the liquid drawn from the condenser to the second column.

54. (New) An apparatus according to claim 53, wherein at least one of said columns is a packed column or a wetted wall column;

wherein the packed column uses structured packing that is promoting-fluid-dispersion structured packing or non-promoting-fluid-dispersion structured packing, where the promoting-fluid-dispersion structured packing comprises a plurality of wave-shaped thin plates disposed parallel to the column axis and made into the form of a block by layering the plates so that they come into contact with one another, and the non-promoting-fluid-dispersion structured packing comprises a honeycomb structure or a

lattice structure;

wherein the honeycomb structure comprises plates parallel to the direction of the axis of the column; and

the lattice structure comprises a plurality of mutually parallel plates and a plurality of plates which are arranged at right angles with respect to said mutually parallel plates, and the mutually parallel plates which are arranged at right angles are positioned along the direction of the column axis.

55. (New) An apparatus according to claim 53, further comprising a hydrogenation device that adds hydrogen to the liquid or vapor drawn from one of the columns.

56. (New) An apparatus according to claim 53, further comprising an isotope scrambler that enriches an isotope-enriched liquid or vapor drawn from at least one of said columns, wherein said isotope scrambler is connected to a conduit that returns the isotope-enriched liquid or vapor to at least one of said columns.